

II. CLAIM AMENDMENTS

1.- 45. (Cancelled)

46. (Withdrawn) A method of operating an apparatus for suppressing noise in a signal accompanied by noise, the method comprising:

- determining, in the apparatus, a first term representing a summation of an estimated periodogram of the signal and a predetermined fraction of an estimated periodogram of the accompanying noise;
- determining, in the apparatus, a second term representing a summation of an estimated periodogram of the signal plus an estimated power spectral density of the accompanying noise; and
- generating, in the apparatus, a noise reducing filter operative on the basis of a ratio of the first term to the second term.

47. (Withdrawn) The method according to claim 46, further comprising determining the first term as a summation of an estimated periodogram of the signal and a predetermined fraction of an estimated periodogram of the accompanying noise divided by the noise power spectral density.

48. (Withdrawn) The method according to claim 46, further comprising choosing the predetermined fraction of the estimated periodogram of the accompanying noise included in the first term, so as to include a desired amount of noise in a resulting noise suppressed signal.

49. (Withdrawn) The method according to claim 48, further comprising choosing the predetermined fraction of the estimated periodogram of the accompanying noise included in the first term to provide an acceptable level of context information in a resulting noise suppressed signal.

50. (Withdrawn) The method according to claim 46, further comprising choosing the predetermined fraction of the estimated periodogram of the accompanying noise included in the first term to be below a mask limit of the signal, so that the noise not audible to a listener.

51. (Withdrawn) A method of operating an apparatus for suppressing noise in a signal accompanied by noise, the method comprising:

- determining, in the apparatus, a first term representing a summation of an estimated periodogram of the signal and a predetermined fraction of an estimated power spectral density of the accompanying noise;
- determining, in the apparatus, a second term representing a summation of an estimated periodogram of the signal plus the estimated power spectral density of the accompanying noise; and
- generating, in the apparatus, a noise reducing filter operative on the basis of a ratio of the first term to the second term.

52. (Withdrawn) The method according to claim 51, further comprising determining the first term as a summation of an estimated periodogram of the signal and a predetermined fraction of an estimated power spectral density of the accompanying noise divided by the noise power spectral density.

53. (Withdrawn) The method according to claim 51, further comprising choosing the predetermined fraction of the estimated power spectral density of the accompanying noise included in the first term, so as to include a desired amount of noise in a resulting noise suppressed signal.

54. (Withdrawn) The method according to claim 53, further comprising choosing the predetermined fraction of the estimated power spectral density of the accompanying noise included in the first term to provide an acceptable level of context information in a resulting noise suppressed signal.

55. (Withdrawn) The method according to claim 51, further comprising choosing the predetermined fraction of the estimated power spectral density of the accompanying noise included in the first term to be below a mask limit of the signal, so that the noise is not audible to a listener.

56. (Withdrawn) An apparatus for suppressing noise in a signal accompanied by noise, the apparatus configured to:

- determine a first term representing a summation of an estimated periodogram of the signal and a predetermined fraction of an estimated periodogram of the accompanying noise;
- determine a second term representing a summation of an estimated periodogram of the signal plus an estimated power spectral density of the accompanying noise; and
- generate a noise reducing filter operative on the basis of a ratio of the first term to the second term.

57. (Withdrawn) The apparatus of claim 56, wherein the apparatus is further configured to determine the first term as a summation of an estimated periodogram of the signal and a predetermined fraction of an estimated periodogram of the accompanying noise divided by the noise power spectral density.

58. (Withdrawn) The apparatus according to claim 56, wherein the apparatus is further configured to choose the predetermined fraction of the estimated periodogram of the accompanying noise included in the first term, so as to include a desired amount of noise in a resulting noise suppressed signal.

59. (Withdrawn) The apparatus according to claim 58, wherein the apparatus is further configured to choose the predetermined fraction of the estimated periodogram of the accompanying noise included in the first term to provide an acceptable level of context information in a resulting noise suppressed signal.

60. (Withdrawn) The apparatus according to claim 56, wherein the apparatus is further configured to choose the predetermined fraction of the estimated periodogram of the accompanying noise included in the first term so that it is below a mask limit of the signal so that the noise is not audible to a listener.

61. (Withdrawn) An apparatus for suppressing noise in a signal accompanied by noise, the apparatus configured to:

- determine a first term representing a summation of an estimated periodogram of the signal and a predetermined fraction of an estimated power spectral density of the accompanying noise;
- determine a second term representing a summation of an estimated periodogram of the signal plus the estimated power spectral density of the accompanying noise; and
- generate a noise reducing filter operative on the basis of a ratio of the first term to the second term.

62. (Withdrawn) The apparatus according to claim 61, wherein the apparatus is further configured to determine the first term as a summation of an estimated periodogram of the desired signal and a predetermined fraction of an estimated power spectral density of the accompanying noise divided by the noise power spectral density.

63. (Withdrawn) The apparatus according to claim 61, wherein the apparatus is further configured to choose the predetermined fraction of an estimated power spectral density of the accompanying noise included in the first term, so as to include a desired amount of noise in a resulting noise suppressed signal.

64. (Withdrawn) The apparatus according to claim 63, wherein the apparatus is further configured to choose the predetermined fraction of the estimated power spectral density of the accompanying noise included in the first term to provide an acceptable level of context information in a resulting noise suppressed signal.

65. (Previously Presented) The apparatus according to claim 61, wherein the apparatus is further configured to choose the predetermined fraction of an estimated power spectral density of the accompanying noise included in the first term is to be below a mask limit of the signal, so that the noise is not audible to a listener.

66. (Withdrawn) An apparatus for suppressing noise in a signal accompanied by noise, the apparatus comprising:

- a noise estimator configured to determine a first term representing a summation of an estimated periodogram of the signal and a predetermined fraction of an estimated periodogram of the accompanying noise;

- a noise estimator configured to determine a second term representing a summation of an estimated periodogram of the signal plus an estimated power spectral density of the accompanying noise; and
- a noise reducing filter generator configured to generate a noise reducing filter operative on the basis of a ratio of the first term to the second term.

67. (Withdrawn) An apparatus for suppressing noise in a signal accompanied by noise, the apparatus comprising:

- means for determining a first term representing a summation of an estimated periodogram of the signal and a predetermined fraction of an estimated periodogram of the accompanying noise;
- means for determining a second term representing a summation of an estimated periodogram of the signal plus an estimated power spectral density of the accompanying noise; and
- means for generating a noise reducing filter operative on the basis of a ratio of the first term to the second term.

68. (Withdrawn) An apparatus for suppressing noise in a signal accompanied by noise, the apparatus comprising:

- a noise estimator configured to determine a first term representing a summation of an estimated periodogram of the signal and a predetermined fraction of an estimated power spectral density of the accompanying noise;
- a noise estimator configured to determine a second term representing a summation of an estimated periodogram of the signal plus the estimated power spectral density of the accompanying noise; and
- a noise reducing filter generator configured to generate a noise reducing filter operative on the basis of a ratio of the first term to the second term.

69. (Withdrawn) An apparatus for suppressing noise in a signal accompanied by noise, the apparatus comprising:

- means for determining a first term representing a summation of an estimated periodogram of the signal and a predetermined fraction of an estimated power spectral density of the accompanying noise;

- means for determining a second term representing a summation of an estimated periodogram of the signal plus the estimated power spectral density of the accompanying noise; and
- means for generating a noise reducing filter operative on the basis of a ratio of the first term to the second term.

70. (Currently Amended) A method of ~~operating an apparatus for~~ suppressing noise in an audio signal ~~containing~~comprising a speech component and a noise component to provide a noise suppressed audio signal, the method comprising:

- ~~causing an apparatus to make~~in the apparatus, an frequency domain estimate of the noise component and an frequency domain estimate of the speech component together with ~~some but not all~~ a predetermined fraction of the noise component;
- using the estimates in the apparatus to generate a noise reducing filter having a frequency-dependent gain coefficient function to control ~~the~~ a gain of the audio signal ~~containing noise~~ to suppress the noise component,

wherein a first estimation of the frequency-dependent gain coefficient function is made adaptively in the apparatus and the first estimation is used to produce a noise estimation which is then used in the apparatus to produce a second estimation of the frequency-dependent gain coefficient function, ~~wherein no use is made of voice activity detection to detect non-speech periods.~~

71. (Currently Amended) The method according to claim 70, in which the ~~level~~predetermined fraction of the noise component ~~included in the estimate of the speech together with some noise~~ is ~~variable~~chosen so as to ~~include~~provide a desired amount of noise in the noise suppressed audio signal.

72. (Currently Amended) The method according to claim 71, in which the ~~level~~predetermined fraction of the noise component is chosen so as to ~~provides an acceptable level of context information~~ amount of noise in the noise suppressed audio signal which naturally represents environmental background noise.

73. (Currently Amended) The method according to claim 70, in which the levelpredetermined fraction of the noise component is chosen so as to provide an amount of noise in the noise suppressed audio signal that is below a perceptual masking limit of the speech component and so is not audible to a listener.

74. (Currently Amended) The method according to claim 70, in which the levelpredetermined fraction of the noise component is chosen so as to provide an amount of noise in the noise suppressed audio signal that approaches thea perceptual masking limit of the speech and so that somea predetermined amount of noise context information is left in the noise suppressed audio signal.

75. (Currently Amended) The method according to claim 70, in which the frequency domain estimated of the noise component is an estimate of power spectral density.

76. (Cancelled)

77. (Currently Amended) A noise suppressor for suppressing noise in an audio signal containingcomprising a speech component and a noise component to provide a noise suppressed audio signal, the noise suppressor being configured to:

- make an frequency domain estimate of the noise component and an frequency domain estimate of the speech component together with some-but-not-alla predetermined fraction of the noise component;
- use the estimates to generate a noise reducing filter having a frequency-dependent gain coefficientfunction to control thea gain of the audio signal containing noise to suppress the noise component,

wherein the apparatus is configured to make a first estimation of the frequency-dependent gain coefficientfunction adaptively and to use the first estimation to produce a noise estimation which is then used to produce a second estimation of the frequency-dependent gain coefficientfunction, wherein no use is made of a voice activity detector to detect non-speech periods.

78. (Currently Amended) The noise suppressor according to claim 77, in which the levelpredetermined fraction of the noise component included in the estimate of the speech

~~together with some noise is variable~~chosen so as to ~~include~~provide a desired amount of noise in the noise suppressed audio signal.

79. (Currently Amended) The noise suppressor according to claim 78, in which the ~~level~~predetermined fraction of the noise component is chosen so as to provide an acceptable ~~level of context information~~amount of noise in the noise suppressed audio signal which naturally represents environmental background noise.

80. (Currently Amended) The noise suppressor according to claim 77, in which the ~~level~~predetermined fraction of the noise component is chosen so as to provide an amount of noise in the noise suppressed audio signal that is below a perceptual masking limit of the speech component and so is not audible to a listener.

81. (Currently Amended) The noise suppressor according to claim 77, in which the ~~level~~predetermined fraction of the noise component is chosen so as to provide an amount of noise in the noise suppressed audio signal that approaches the perceptual masking limit of the speech and ~~so that some~~a predetermined amount of noise context information is left in the noise suppressed audio signal.

82. (Currently Amended) The noise suppressor according to claim 77, in which the frequency-domain estimated of the noise component is an estimate of power spectral density.

83. (Cancelled)

84. (Currently Amended) A communications terminal comprising a noise suppressor for suppressing noise in an audio signal comprising a speech component and a noise component to provide a noise suppressed audio signal, the noise suppressor being configured to:

- make an frequency-domain estimate of the noise component and an frequency-domain estimate of the speech component together with ~~some but not all~~a predetermined fraction of the noise component;
- use the estimates to generate a noise reducing filter having a frequency-dependent gain ~~efficient~~function to control ~~the~~a gain of the audio signal ~~containing noise to suppress the noise component,~~

wherein the apparatus is configured to make a first estimation of the frequency-dependent gain coefficientfunction adaptively and to use the first estimation to produce a noise estimation which is then used to produce a second estimation of the frequency-dependent gain coefficientfunction, ~~wherein no use is made of a voice activity detector to detect non-speech periods.~~

85. (Currently Amended) A communications network comprising a noise suppressor for suppressing noise in an audio signal comprising a speech component and a noise component to provide a noise suppressed audio signal, the noise suppressor being configured to:

- make an frequency-domain estimate of the noise component and an frequency-domain estimate of the speech component together with ~~some but not all~~ a predetermined fraction of the noise component;
- use the estimates to generate a noise reducing filter having a frequency-dependent gain coefficientfunction to control the gain of the audio signal ~~containing noise~~ to suppress the noise component,

wherein the apparatus is configured to make a first estimation of the frequency-dependent gain coefficientfunction adaptively and to use the first estimation to produce a noise estimation which is then used to produce a second estimation of the frequency-dependent gain coefficientfunction, ~~wherein no use is made of a voice activity detector to detect non-speech periods.~~

86. (Currently Amended) A noise suppressor for suppressing noise in an audio signal containing ~~comprising~~ a speech component and a noise component to provide a noise suppressed audio signal, the noise suppressor comprising:

- means for making a frequency-domain estimate of the noise component;
- means for making a frequency-domain estimate of the speech component together with ~~some but not all~~ a predetermined fraction of the noise component;
- means for using the estimates to generate a noise reducing filter having a frequency-dependent gain coefficientfunction to control the gain of the audio signal ~~containing noise~~ to suppress the noise component,

wherein the apparatus is configured to make a first estimation of the frequency-dependent gain coefficientfunction adaptively and to use the first estimation to produce a noise estimation which is then used to produce a second estimation of the frequency-dependent gain

~~coefficient~~function, wherein no use is made of a voice activity detector to detect non-speech periods.